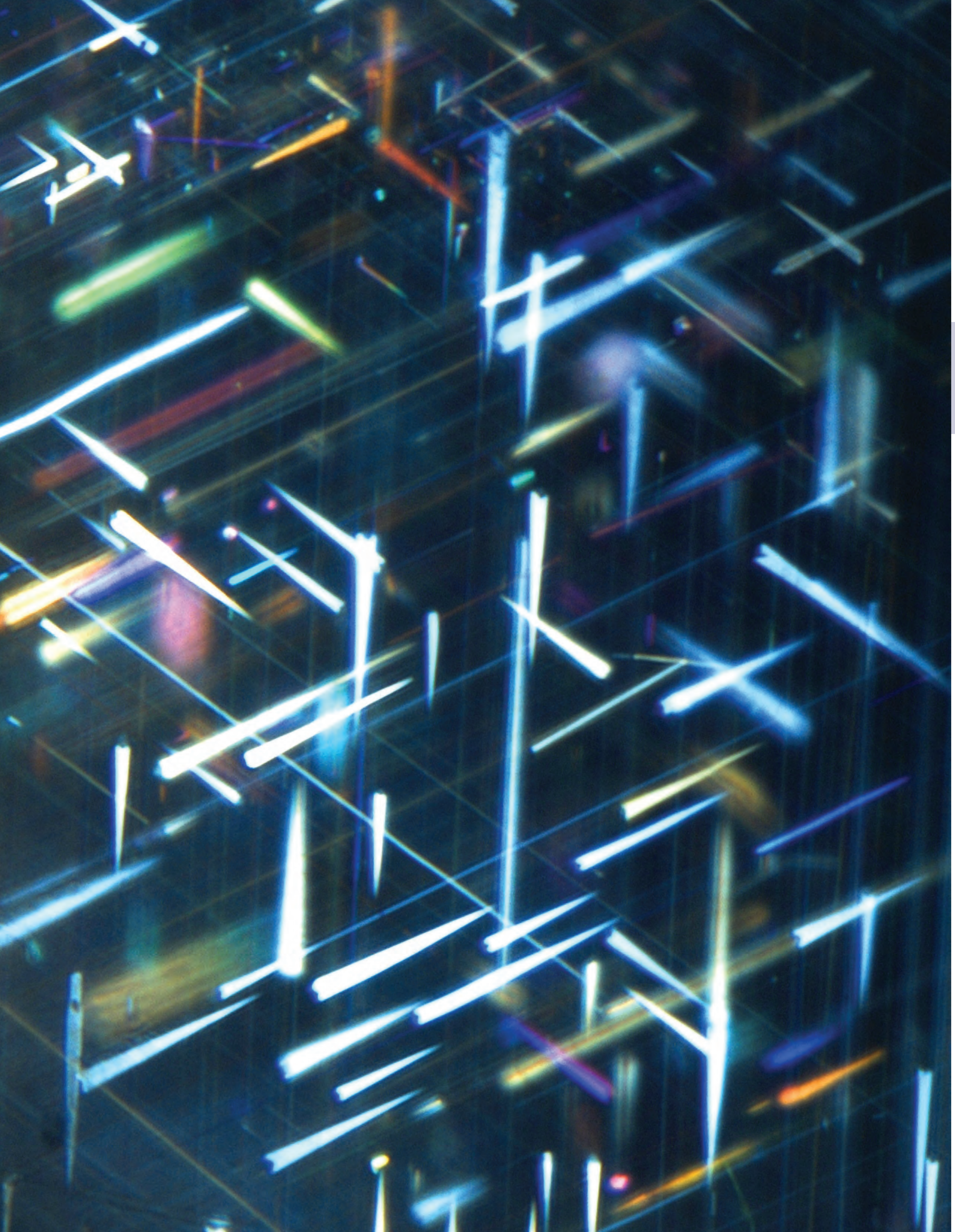


The Starry Night Sapphire

Vincent van Gogh, The Starry Night, *1889, Oil on Canvas, 29 x 36.25 inches, Courtesy the Museum of Modern Art, New York, New York.*

GIA Monograph — The Starry Night Sapphire

"This morning I saw the country from my window a long time before sunrise with nothing but the morning star, which looked very big." — Vincent van Gogh

Introduction

Man's extraordinary ability to encounter natural phenomena and respond with wonder makes the human experience unique. Throughout time man has sought to create lasting emblems to commemorate the excitement of these perceptions, since the experience itself can be fleeting. Historically, the visual arts have taken responsibility for capturing and exalting these sensations. Van Gogh, for example, memorialized on canvas the awe inspired in him by his external world, and its impact on (or interaction with) his internal landscape. Through the painting process he learned more about himself, with each work refining his ability to communicate his feelings to others. Such a shared experience is seen in his painting titled *The Starry Night*, which attempts to encapsulate the overwhelming sensation of the clear and dazzling night sky. From van Gogh's stylistic choices in painting it, the viewer is immediately aware of the emotional impact a nocturnal environment imparts on him. The painting embodies an inner, subjective expression of van Gogh's response to nature. Van Gogh leaves behind the Impressionist doctrine of truth to nature in favor of restless feeling and expressionism.

The Starry Night Sapphire
Weight: 111.96 carats
Measurements: 27.1 x 23.7 x 16.9 mm
Shape: Oval
Cutting style: Cabochon
Transparency: Translucent
Color: Blue
Phenomenon: Asterism
Geologic Source Type: Classic Metamorphic (CMT) Type I
Geographic origin: Burma (Myanmar)

We are fortunate to have other objects—constructed from other media—that convey wonder. The Starry Night Sapphire, so named for the van Gogh painting and the subject of this GIA Monograph, is such an example. Contemplating its relationship to art forms like painting or sculpture, we must allow it a rightful place in the circle of objects we consider fine art. The inspiration for creating a painting and a gemstone may appear to be quite different, but there are many interesting parallels. Each starts from the basic belief that the creative act will yield an object of emotion and contemplation. Each undertaking recognizes the potential need to react and change in the process. Neither knows exactly what the end product will look like until it is done. The work in progress often informs the finished piece. The starting material may differ but the final intent is essentially identical: both ultimately seek to create unprecedented visual experiences. In the case of the Starry Night Sapphire, that unique, staged experience coincides with another extreme rarity: encountering a gemstone in excess of 100 carats is truly phenomenal. The use of the word phenomenal is particularly fitting for this gem in more ways than one. In the gem trade, stones displaying an optical effect like the Starry Night Sapphire's asterism are referred to as phenomenal gemstones.

Observing van Gogh's The Starry Night in tandem with its namesake sapphire gives us much to contemplate and enjoy. Just like stars in the night sky, the sapphire's star requires certain viewing conditions. In van Gogh's The Starry Night the sky swirls. He shows the movement of the sky, and through that movement implies the passage of time. While we know that time will render the stars invisible as night gives way to day, we can excitedly anticipate their return as time marches on. Furthermore, our anticipation reminds us of the cyclical nature of time. With the Starry Night Sapphire, time is rendered through the movement of the gemstone. This movement allows the star to rotate across its surface, similarly acknowledging the effect of time. And, in certain lighting conditions the star is not readily visible. For those having seen it, the desire to return to the condition where it is displayed parallels the anticipation of passing time and the return of the night sky. Time does not alter the appearance, but does continue to deepen our appreciation. The nearly round outline of the sapphire gently reinforces the theme of the circular nature of time.

With painting, the act of framing can add to the presentation and meaning of the piece. It can set the stage for how we interpret the piece. With the Starry Night Sapphire, this act is achieved with the mounting. The full effect of the brooch, with its exceptional center stone and numerous faceted accent diamonds, is also contingent on movement and motion. And the curled bow- and ribbon-like extensions on either side of the brooch give it a sense of its capability for movement or pliability, rather than the static appearance of weightier or more symmetrical jewelry designs.

This monograph documents the exceptional Starry Night Sapphire's gemological characteristics, which will help us understand the optical impact of the gem, where it came from, and how it formed. In its finished state, its relationship to painting helps to realize how close these objects of appreciation (gemstones and visual art) really are, and places the Starry Night Sapphire in context with its rightful extended family.

“Blue gives other colors their vibration.” — Cézanne

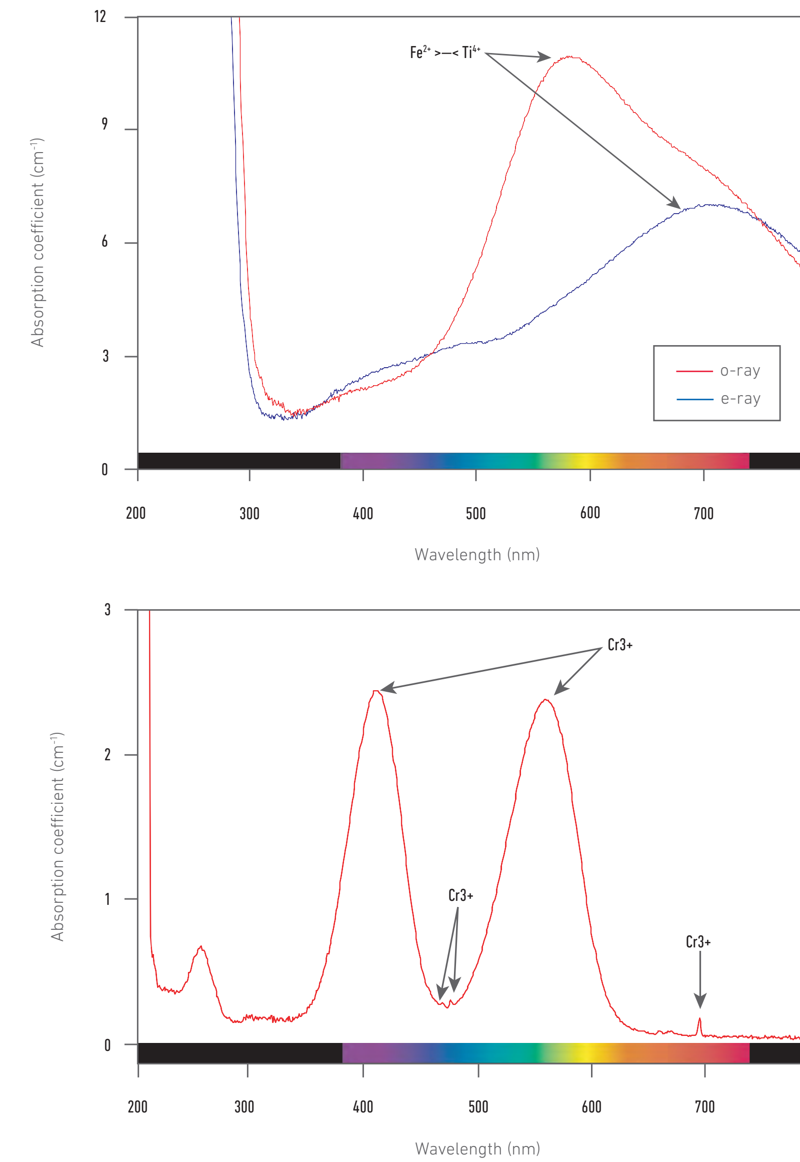
Corundum and its Color

The modern English word *sapphire* can be traced to the old French *safir* and Latin *sapphirus*, and to the Greek *sappheiros*. Similar words also exist in Hebrew (*sappīr*), Persian (*saffir*), and Arabic (*çafīr*). The ultimate source may be the Sanskrit *sanipriya*, meaning “precious to the planet Saturn.”

Today we know sapphire as one gem variety of the mineral corundum—Al_2O_3. Sapphire is frequently associated with the color blue; however, corundum occurring in any hue other than red is classified as sapphire. In the case of red, a separate variety of corundum exists: ruby. Corundum varieties are the most popular colored gemstones. With a hardness of 9 on the Mohs scale (diamond, at 10, is the only harder material) and a variety of available colors, sapphire is well suited for use in jewelry.

Color in corundum is controlled by the trace element chemistry. Quite unlike a painter or gemstone cutter, whose choice or manipulation of color is quite deliberate, nature is haphazard with her medium. The apparent color in sapphire and ruby is caused by small concentrations of trace elements and defects in the crystal lattice. The geological conditions of corundum formation govern the trace element profile and defect concentration in a given crystal. The geological environment dictates which particular elements—and how much—are available for incorporation during corundum growth, because these elements reflect the chemistry of the other minerals in the host rock or fluid. Furthermore, the geochemical system controls the oxidation state of the trace elements; for example, whether iron (Fe) is incorporated as Fe^{2+} or Fe^{3+}.

Blue color in corundum, such as in the Starry Night Sapphire, is produced by the formation of iron-titanium (Fe^{2+}-Ti^{4+}) pairs in the lattice. It is not simply enough for the gem to contain both ions; the blue coloration is produced only when the two atoms are adjacent in the structure and share electrons with one another. Other ions, such as magnesium (Mg^{2+}), interfere with this pairing and prevent or suppress blue color appearance. The Fe^{2+}-Ti^{4+} pairs are very effective chromophores, and blue sapphires with medium tones typically contain less than several dozen to hundred parts per million atomic (ppma) of these pairs. These pairs absorb light in the red to green region of the visible spectrum, with absorption bands at 580 nm and 700 nm. A relative “transmission window” between 400-500 nm in the blue region of the spectrum gives rise to the blue color in the sapphire.



Top: Ultraviolet-visible-near infrared absorption spectrum of a Czochralski-grown synthetic blue sapphire. The data were collected from an oriented wafer sample 0.65 mm thick, and both the ordinary and extraordinary ray spectra are shown. This high-purity sample contains virtually only Fe and Ti, so all absorption features seen here can be attributed to these trace elements, in particular, the broad absorption bands centered at 580 and 700 nm. Note that a relative “transmission window” is created in the blue (o-ray) and blue-green (e-ray) region of the visible spectrum as shown by the low portions of the two curves between 400-550 nm. This is the reason sapphire appears blue, and shows pleochroic colors of violet-blue and blue-green. Bottom: Ultraviolet-visible-near infrared absorption spectrum of a Czochralski-grown, laser-grade synthetic ruby. The data were collected from an oriented wafer sample 1.96 mm thick, and the ordinary ray spectrum is shown. This high-purity sample contains virtually only chromium (Cr) in its trace element profile, so all absorption features seen here can be attributed to this element. These include the broad bands at 415 and 560 nm, and the sharp lines at 470, 475, and 694 nm. Note that relative “transmission windows” are created in the red and blue regions of the visible spectrum (the low portions of the curve between 600-700 nm and 450-520 nm, respectively), giving ruby its characteristic vibrant red color.

Red color in corundum, in contrast, is caused by single ions of chromium (Cr^{3+}). These ions are strong light absorbers; however, they are much weaker chromophores than Fe^{2+}-Ti^{4+} pairs. Chromium ions absorb strongly at 415 nm and 560 nm, creating relative transmission windows in the red and blue-to-violet regions of the spectrum. Gem-quality ruby typically contains on the order of several hundred to several thousand ppma of Cr^{3+}. In comparing a ruby and a sapphire of equivalent depth of color, recent unpublished calculations estimate that almost five and a half times as many Cr^{3+} ions as Fe^{2+}-Ti^{4+} pairs are required to produce equivalent intensities of red and blue in corundum.

Of course, the coloration of corundum is not nearly as simple as pure blue or pure red, as no natural corundum crystal contains only Fe^{2+}-Ti^{4+} pairs or only Cr^{3+} ions, or in the exact same concentration as another crystal. These coloring agents can occur together, "mixing" to create a blend of blue and red, and they can occur along with other color-causing impurities in varying concentrations. In this way nature produces a wide variety of hues in various tones and saturations that rivals that found on the palette of any artist. It is quite interesting that such slight variations in chemistry can produce a range of blue in sapphire—from light to dark—tantamount to that chosen by van Gogh to represent his starry night. And pleasing tones due to low trace element content occur in hues other than blue; we have to look no further than a padparadscha sapphire to be convinced this is operative for red as well. Furthermore, it is incredible that such a small amount of a trace element—only a few hundred atoms of Cr^{3+} per million corundum atoms, for example, nearly negligible in the macroscopic world—can produce in a ruby a red as rich as that used by van Gogh in his *The Night Café*.

We are left to contemplate how nature's "choice" of trace element chemistry pre-selects the color produced in corundum, virtually unintentionally and yet in a manner that impresses the beholder so deeply. In comparison, an artist makes a very calculated choice of color in order to evoke a response from the viewer. Amazingly, in the end, the results of both are remarkably similar.

The Burmese ruby (GIA report number 2125906944) in this ring is a stunning example of the vibrant "pigeon blood" hue of corundum colored by a moderately high trace amount of Cr. This Edwardian Era ring, set with a pale blue sapphire (GIA report number 5121906941) and a padparadscha sapphire (GIA report number 51219063943), is a wonderful example of the delicate, light tones that can be produced in corundum by very low trace element contents.

Vincent van Gogh, The Night Café*, 1888, Oil on Canvas, 28.5 x 36.3 inches, Courtesy the Yale University Art Gallery, New Haven, Connecticut.*

This sketch shows the King's Light Infantry camp in Mogok, Burma, drawn for the February 19, 1887 edition of The Illustrated London News. *This followed the 1885 British annexation of Upper Burma, converting it into a province of India, following the third Anglo-Burmese War. The commerce of gemstones from Mogok was reestablished with the West soon thereafter.*

"Although certain Sri Lankan sapphires may rival them in beauty, the Burmese stones are of a deeper, richer color, there being simply more color inside those from Mogok. Moreover, the Mogok stones do not require heat treatment for their beauty, but come out of the ground in living color, a blaze of smoldering, imperial blue. Many fine star sapphires have been found in the Mogok area, some of large size."
— *Richard W. Hughes*, Ruby & Sapphire

Geographic Origin and Corundum

In general, color is the primary criterion in evaluating and comparing gems. However, in the ruby and sapphire trade, the geographic origin of a stone is nearly—some may say equally—important to assessing its value. Where a stone was mined is tantamount to its pedigree, and various locations conjure particular associations and assumptions. The trade expects that a Sri Lankan sapphire will be a delicate blue, for example, and certainly an Australian sapphire will be dark. As with any stereotyping, falsehoods and mistaken impressions abound. It is only with careful study and documentation that any attempt at generalization can be made.

As described in the gemological assessment section of the monograph, GIA staff determined that the Starry Night Sapphire was mined in Burma. In order to clarify the reasoning for this determination, and also to build appreciation for its meaning, it is useful to consider the details of Burmese sapphires and their mining history. Sapphires were probably first recovered in the Mogok area as far back as the Stone Age. However, according to local legend, Mogok was founded in 579 AD, and various stories indicate that sapphires were discovered at about that time. Numerous accounts associating sapphire and ruby with Mogok have been described in gemological literature dating back for centuries.

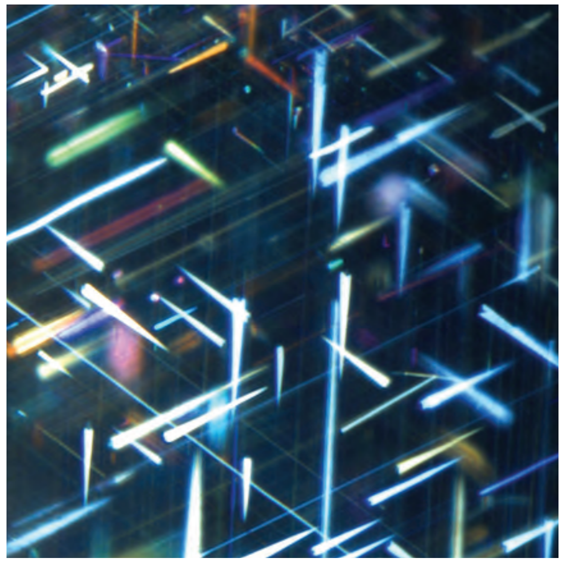
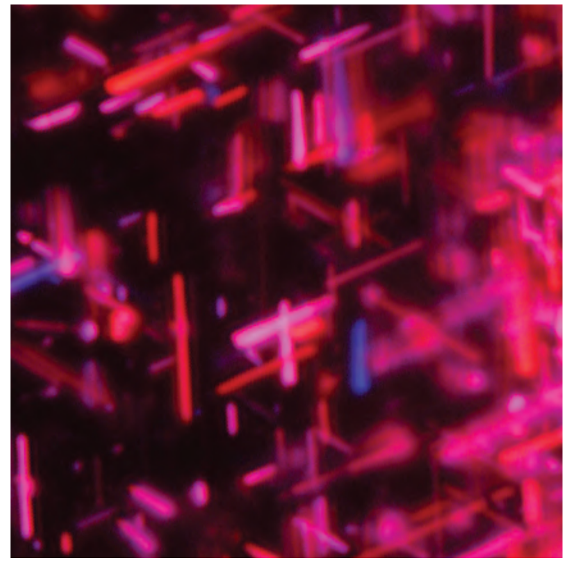
The British East India Company first explored the Mogok area in the early 17th century. In 1885, the British annexed Upper Burma, and the London jeweler E.W. Streeter formed a syndicate to work Mogok's ruby and sapphire mines. The first systematic description of the Mogok deposits came in an 1887 report by C. Barrington Brown, who had been sent to the area by the Secretary of State for India. The syndicate led by Streeter eventually joined with the Rothschilds, who were investment bankers in Europe, to form the Burma Ruby Mines Ltd. in 1889. Fairly large-scale mechanized mining of these precious gems continued from that time virtually unabated for some 30 years, bringing a bevy of vibrant rubies and sapphires to the marketplace.

Following independence from the British in 1948, small-scale mining continued with the addition of government-organized mechanized operations and centralized washing plants. Few western observers and buyers were allowed to enter Mogok between 1962 and 1991. However, since then more have been permitted entrance to this wondrous valley, albeit intermittently. "Welcome to Ruby Land" reads a sign crossing the road, beckoning entry into the fabled valley.

Today Burma has been re-named Myanmar by the government. Nevertheless, in deference to historical precedent, and as an acknowledgement of the gem's peerless pedigree, connoisseurs still refer to the sapphires and rubies from Mogok as "Burmese." As is the case with many rural areas in Asia, men take care of the land (or the mining, in the case of Mogok) while women oversee business. Keen-sighted and shrewd businesswomen dominate the sapphire and ruby market in Mogok. Their love for the gems passing through their hands is evident in their smiling eyes and soft voices. They handle the stones with calm dexterity, suggesting that gem trading is a well-honed skill they developed in their formative years.

Famed London jeweler, Edwin Streeter, shown here, formed a syndicate in 1885 to successfully work the Mogok ruby and sapphire mines.

Opposite: This recent view of Mogok shows the town center and lake. It was once the site of the most significant gem producing mines worked by Burma Ruby Mines Ltd.

Shown are exsolved rutile arrowheads in the Starry Night Sapphire and in a Mogok ruby (GIA report number 1122895889). These reflective triangular features are frequently observed within nests of rutile needle silk in sapphires and rubies from Burma.

Burmese Sapphires

Sapphires mined in the Mogok tract of Burma carry the indelible mark of the geological environment in which they formed. The distinct chemical fingerprint and inclusion scene characterizing Burmese sapphires helps gemologists differentiate them from sapphires mined in other locations.

The sapphires of Burma likely originated in pegmatites and nepheline-corundum syenites (i.e., silica-poor, alumina-rich igneous rocks). Burmese rubies are mined in close proximity to the sapphires; both are recovered from secondary deposits. However, the rubies likely formed in marbles (metamorphosed limestones). The different host rocks for sapphire and ruby account for differences in trace element chemistry and inclusion scenes of the two varieties.

Burmese sapphires and rubies are characterized by dense clouds of exsolved rutile silk. The silk tends to be dense, formed by closely packed, short rutile needles intersecting at angles of 60 and 120 degrees. These needles lie in the basal plane and are parallel to the faces of the second-order hexagonal prism, hinting at the crystallographic orientation of the rough crystal. It is not unusual for the silk to contain spike or dart-shaped iridescent films, a feature gemologists have nicknamed “arrowheads.” It is not surprising that many

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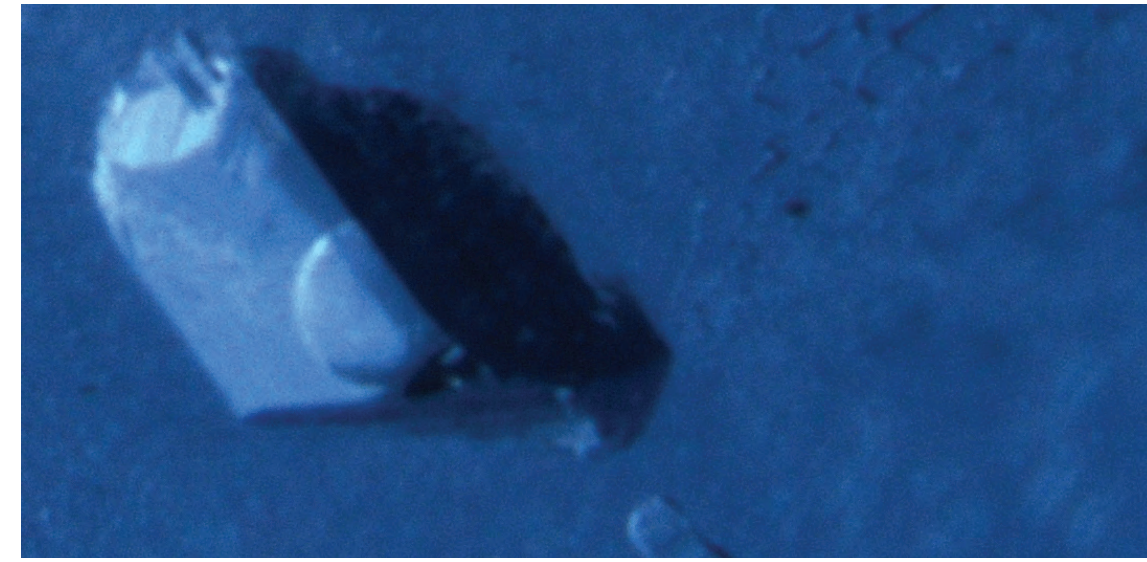
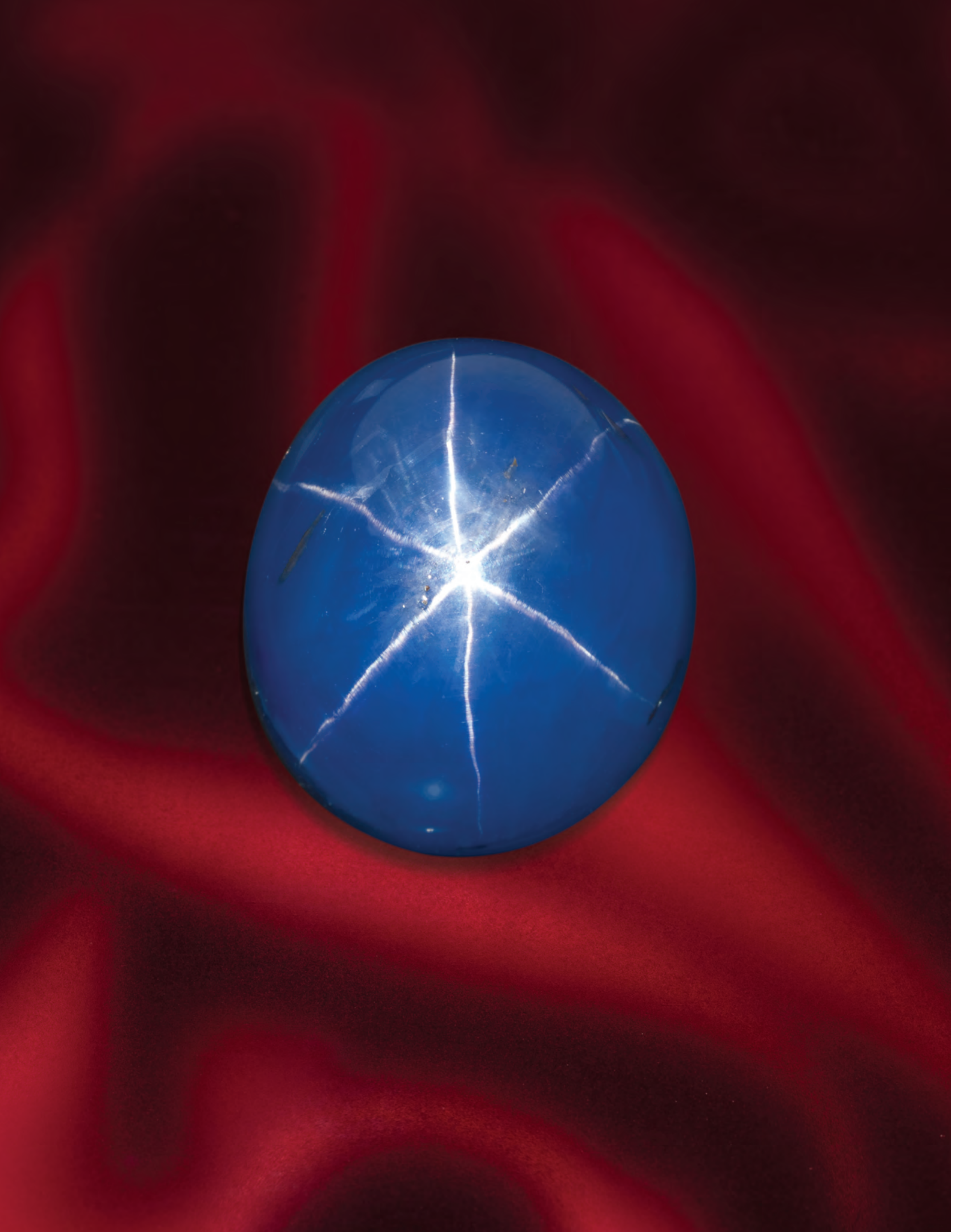


Shown is a negative crystal in the Starry Night Sapphire. Note the geometric liquid films in the upper right corner of the image.

fine-quality star corundum have been found in Burma, since the dense rutile silk is responsible for the optical phenomenon that creates asterism. The morphology of rutile silk helps separate Burmese sapphires from Sri Lankan ones, since the latter tends to contain silk composed of longer needles that are more loosely spaced and do not tend to associate with dense nests of shorter needles.

The presence of negative crystals is also typical of Burmese sapphires. These often occur as angular features distributed in curved fingerprints, some of which are two-phase (i.e., contain a gas and liquid). Other fingerprints are composed of slender, thread-like fluid channels, and sometimes these fluid fingerprints are superimposed on fingerprints of negative crystals, indicating complex stages of rupturing and secondary healing.

Burmese sapphires are also identifiable by several growth features. They tend to display polysynthetic twinning along the rhombohedron faces, with long white exsolved boehmite needles present along the twinning lamellae. Such twinning is typically not observed in Sri Lankan sapphires. Furthermore, Burmese sapphires tend to have very even color zoning, whereas many Sri Lankan sapphires have sharp, discrete growth layers alternating between blue and colorless.



"Though one may often make a shrewd guess as to the nature of a stone by reason of its colour, lustre, and general appearance, it is often only by measure one or other of its optical or physical 'constants' that one can be really sure of one's ground."

— *B.W. Anderson*, Gem Testing, 10th edition

Gemological Assessment of the Starry Night Sapphire

Characterization of a colored gem in the GIA Laboratory involves a full range of analytical techniques. A variety of traditional approaches—such as measuring refractive index and specific gravity—along with advanced spectroscopic testing builds a thorough understanding of gem identity and treatment history.

Because the gap in market value between stones of equivalent quality but different origin can be enormous, and also because there is a growing concern in the market about gems being mined with sustainable techniques from ethical sources, gemological laboratories like the GIA Laboratory are regularly asked to identify the geographical origin of gemstones.

Furthermore, routine treatment of all types of gemstones is commonly performed to enhance their appearance or durability. Often treatments are undetectable—and undisclosed—to the purchaser. The GIA Laboratory has the necessary analytical instrumentation and industry experience to identify most treatments. Because gems that are untreated have a huge premium placed upon them, GIA also screens each stone and reports on whether any treatments are detectable.

The Starry Night Sapphire was studied with all available instrumentation by a team of experienced GIA gemologists. Their combined observations and data interpretation, which are detailed in this section, indicate that the Starry Night Sapphire is indeed an unheated Burmese gem.

Microscopy

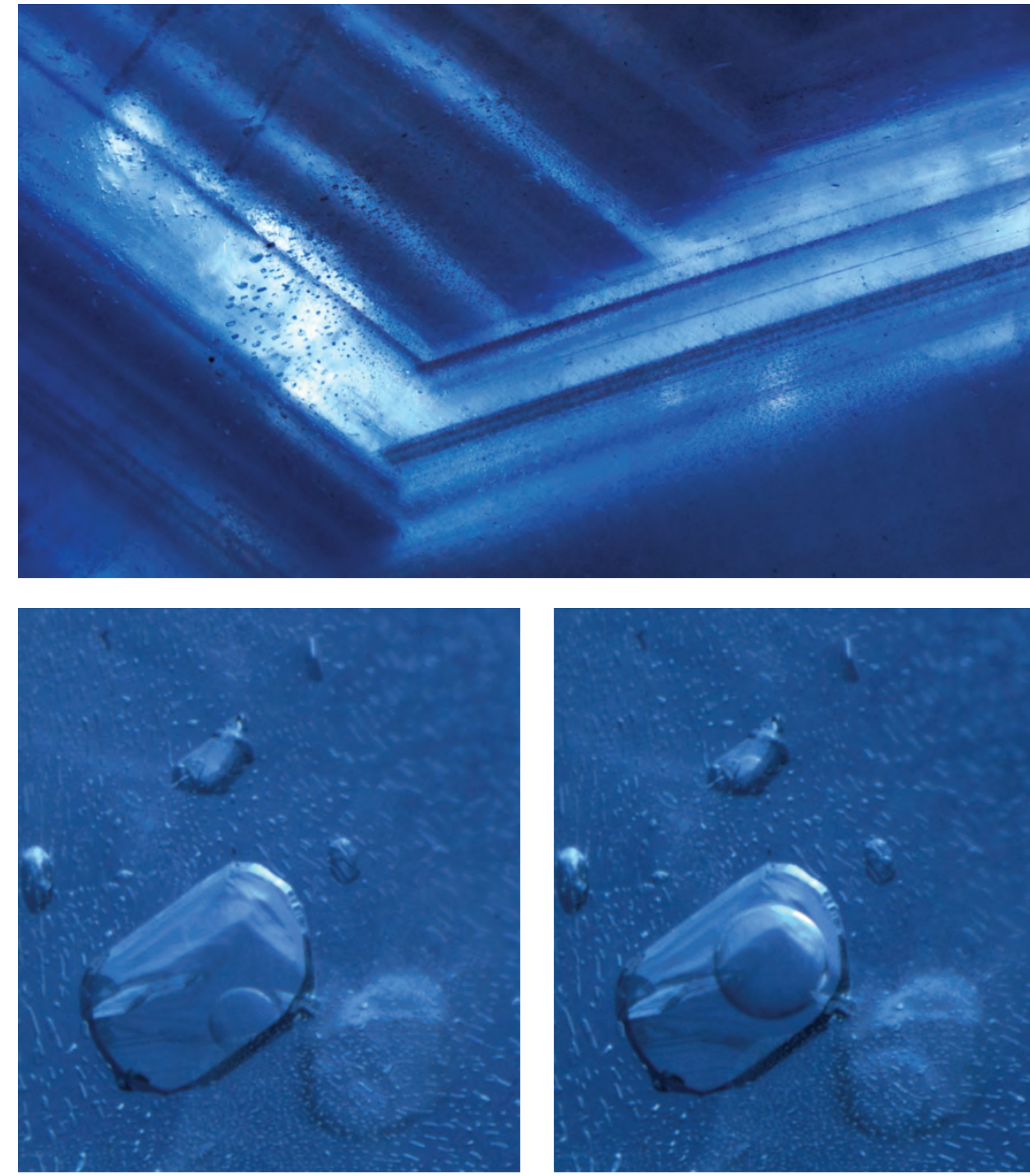
The gemological microscope is the single most useful piece of equipment in a gemological laboratory. With a good-quality binocular microscope and various illumination techniques, an experienced gemologist can make detailed observations and highly accurate assessments. Microscopic observations are useful in determining gem identity, natural versus synthetic, treated versus non-treated, and country of origin.

GIA gemologists observed that the internal characteristics of the Starry Night Sapphire showed features considered highly consistent with sapphires mined in Burma. Fine, long, epitaxial rutile needles were densely packed in a hexagonal pattern mimicking the crystal habit of the rough. Chromophore cannibalization by the dense rutile inclusions was noted. Rutile is titanium dioxide, TiO_2, and when it crystallizes as inclusions in sapphire it appropriates the available titanium, precluding formation of Fe^{2+}-Ti^{4+} pairs. Therefore blue sapphire is often colorless in the immediate vicinity of rutile inclusions, because the rutile has used up all the Ti^{4+} that could otherwise pair with Fe^{2+} to make blue color centers.

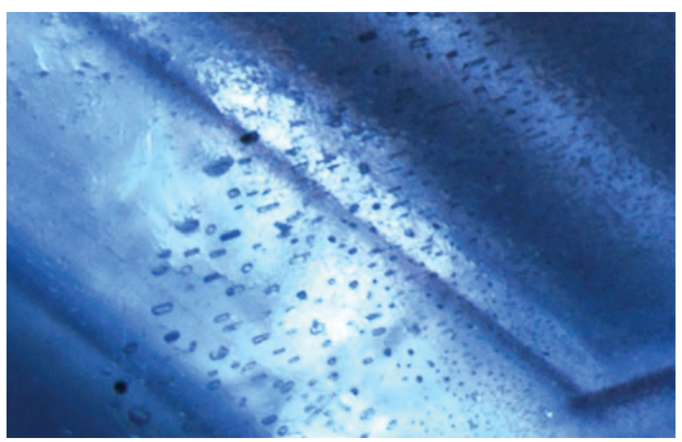
Closely spaced clusters of short iridescent triangular films—called "arrowheads" by gemologists—were interspersed in the rutile silk. The well-formed, compacted silk is responsible for the symmetrical, sharply defined legs of the star. These intact needles are also one indication that the stone has not been heat treated to high temperatures. Many heat treatment procedures are conducted at temperatures high enough to dissolve rutile; in heat-treated, silk-bearing sapphires, the needles are partially dissolved and have a dotted or dashed appearance.

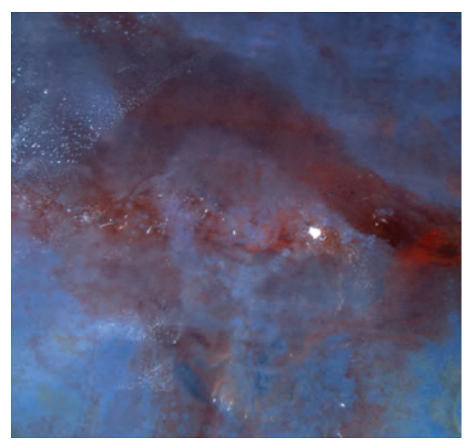
In addition to its characteristic silk and arrowheads, the Starry Night Sapphire had several clusters of negative crystals scattered throughout. Some of these larger negative crystals contained fluids with readily apparent primary carbon dioxide (CO_2) gas bubbles coexisting with a liquid phase, which were identified using Raman spectroscopy. When these negative crystals are heated slightly, the gas phase dissolves in the fluid phase; when the inclusions are cooled, the gas exolves from the liquid. These gas phase inclusions are another good indication that the stone has not been heat treated. Had it been heat treated at high temperature, the gas would have expanded and ruptured the negative crystal, releasing the trapped gas and producing recognizable damage to the inclusion. The Starry Night Sapphire also showed several small dark crystals with what appeared to be irradiation haloes. Their morphology suggested that they were uraninite crystals, but they were located too deep within the gem to be identified conclusively with Raman spectroscopy.

GIA Monograph — The Starry Night Sapphire



Top: Seen here are partial hexagonal growth and color zoning in the Starry Night Sapphire. Bottom: Carbon dioxide gas bubbles trapped in negative crystals are exsolved upon cooling. At left, the negative crystals are shown at room temperature; at right, they are shown after slight cooling with compressed air.



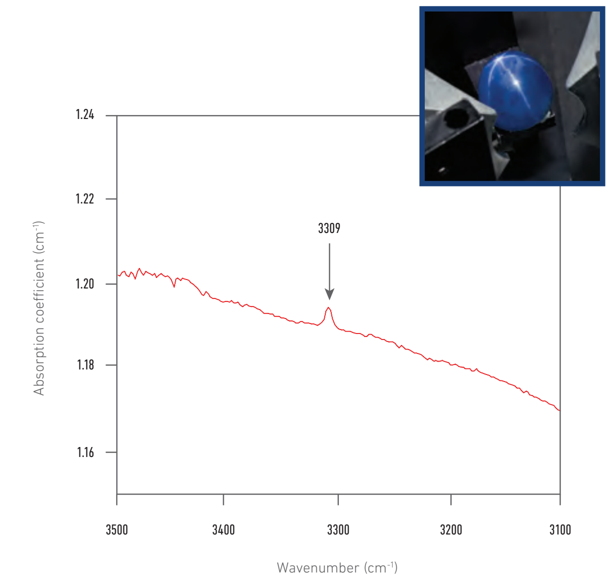


Above Left: Fingerprints of minute crystallites, such as the one shown here, were observed in several areas of the Starry Night Sapphire. Top and Above Right: Epigenetic hematite produced reddish staining in a fissure in the base of the Starry Night Sapphire.

The Starry Night Sapphire contained several highly patterned fluid remnant fingerprints. These fingerprints had a net-like texture of liquid channels. Fingerprints of tiny crystallites were also observed. A fissure in the base of the stone showed reddish staining from epigenetic hematite. This is one other indication that the stone is unheated, as hematite in fissures of treated corundum would lose its red coloration and turn dark upon heating.

Infrared Spectroscopy

Fourier-transform infrared (FTIR) absorption spectroscopy was performed to substantiate that the Starry Night Sapphire is unheated. The FTIR absorption spectrum showed a weak feature at 3309 cm^{-1}. This feature is attributed to hydrogen (in close proximity to oxygen, as the hydroxyl ion (OH^-)) in the corundum lattice. When present in higher concentration, OH^- can produce a series of strong, sharp lines in an FTIR spectrum. These features are quite sensitive to heat; furthermore, they are extremely dependent on oxygen partial pressure in the atmosphere of a heating enviroment. The hydrogen ion, H^+, is quite small and therefore very mobile in the corundum crystal lattice. It can easily diffuse *into* or *out of* the lattice, depending on the oxygen content of the surrounding atmosphere.



The FTIR absorption spectrum of the Starry Night Sapphire showed a weak feature at 3309 cm^{-1}, which is attributed to hydrogen (in close proximity to oxygen, as OH^-).

Typically, heat treatment of corundum is conducted in a controlled atmosphere, and the partial pressure of oxygen in the heating environment governs whether H^+ will enter or exit the lattice of the gem. When corundum is heated in a reducing atmosphere (low pO_2) using conventional heat-treating methods (e.g., a fire plus blowpipe, or a fuel-burning combustion furnace), H_2 gas is commonly produced. In this situation, hydrogen is readily available and diffuses into corundum quite easily, producing a series of sharp, (OH^-)-related features in an FTIR absorption spectrum. Generally this series is not observed in unheated sapphires from metamorphic deposits, and when they are seen in an FTIR absorption spectrum of a metamorphic sapphire they are good evidence of heating under reducing conditions. Unheated metamorphic sapphires typically contain only a trace amount of naturally occurring hydrogen as OH^-, and if this hydrogen is infrared-detectable then only a weak feature at 3309 cm^{-1} is observed, although it is not always present. Conversely, if a metamorphic sapphire is heated in an oxidizing environment (high pO_2), the small amount of H^+ naturally present in the corundum lattice would likely diffuse out of the crystal.

While the weak feature at 3309 cm^{-1} is not conclusive evidence for lack of heat treatment, in the case of the Starry Night Sapphire this observation is consistent with the conclusion.

oxide	TiO_2	V_2O_5	Cr_2O_3	Fe_2O_3	Ga_2O_3
weight percent	0.057	0.003	0.000	0.088	0.006

element	Ti	V	Cr	Fe	Ga
ppmw	342	16.8	0.00	616	44.6
ppma	144	6.73	0.00	224	12.4

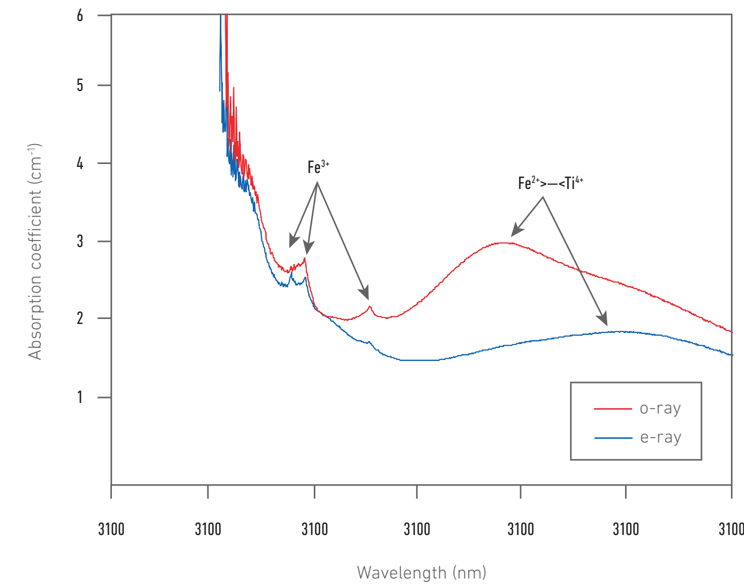
EDXRF data for the Starry Night Sapphire

X-ray Fluorescence Spectroscopy

Chemical analysis is particularly useful because it permits gem identification by determining chemical composition. Furthermore, it can also be used to detect treatments such as glass fillings or metallic coatings. Chemical information is also pertinent to determining the country of origin for sapphires. As discussed previously, sapphire is mostly made of aluminum and oxygen; however, the presence of certain trace elements and their concentration are controlled by the geological environment in which the sapphire formed. The rock assemblages at different geographic locations provided slightly different chemical environments for the sapphires to grow in. Consequently, different mines leave a distinct chemical "fingerprint" that helps determine the geologic source type and country of origin.

Quantitative chemical data for the Starry Night Sapphire collected by energy-dispersive X-ray fluorescence (EDXRF) spectroscopy was used to characterize the trace element chemistry. This non-destructive technique uses X-rays to excite electronic transitions in atoms, and then measures the energy released when the electrons return to their stable states. The particular energies are specific to each element, and therefore are used to determine the presence of different elements.

Chemical data for the Starry Night Sapphire are shown in the table above. Predictably, titanium and iron are the most abundant trace elements. Electron charge transfer between Ti^{4+} and Fe^{2+} ion pairs is responsible for the blue color of sapphires. The amount of Fe—224 parts per million atomic (ppma)—is nonetheless considered low for a sapphire. This indicates that it is from a metamorphic source rock. Sapphires from metamorphic deposits typically have low Fe contents, since they crystallize in Fe-poor marbles and schists. For comparison, sapphires that form in Fe-rich magmatic rocks like basalt can contain several thousand ppma of Fe.



The UV-Vis-NIR absorption spectra of the Starry Night Sapphire showed absorption features attributed to Fe^{3+} and Fe^{2+}-Ti^{4+} pairs.

Ultraviolet-Visible-Near Infrared Spectroscopy

As described previously, trace element chemistry in corundum is intimately linked with absorption features in the ultraviolet-visible-near infrared (UV-Vis-NIR) region of the electromagnetic spectrum. Because UV-Vis-NIR spectroscopy provides qualitative (and, depending on data quality, quantitative) chemical information, and because trace element content is related to geographic origin, features in UV-Vis-NIR absorption spectra aid in country-of-origin determinations at the GIA Laboratory.

Polarized UV-Vis-NIR absorption spectra of the Starry Night Sapphire were collected in the region from 200-1000 nm. The spectra showed a good deal of noise due to scattering of the sample beam of light by the densely packed particulate clouds as it passed through the sample. Nonetheless, the UV-Vis-NIR spectra were well-resolved enough to determine that the Starry Night Sapphire was a metamorphic blue sapphire, showing broad bands at 560 and 700 nm due to Fe^{2+}-Ti^{4+} pairs, as well as a feature at 450 nm from Fe^{3+}, and a distorted but discernable high "shoulder" on the UV absorption edge around 340 nm. These observations—particularly the high shoulder—are consistent with those of other Burmese sapphires.

"What bliss there is in blueness. I never knew how blue blueness could be." — Vladimir Nabokov (1938), Laughter in the Dark

Summary

When an artist mixes color for painting, inspiration can originate from different sources; it can be based on observation or it can be based on inner expression. This creation of color is different from the job of the cutter, who must reveal the inherent color in a gemstone under the quite limited constraints imposed by the trace element chemistry of the rough. Regardless of the original source of inspiration, we are left to behold an object where the effect of color is paramount.

Viewing the Starry Night Sapphire is a meditative experience. Its blue color inspires calm, and its asterism infuses energy through implicit motion. In this way the experience is transformative, generating a sense of peace and a desire for movement. The considerable artistry of the Starry Night Sapphire, combined with its formidable gemological characteristics, render it a truly remarkable piece in the worlds of fine art and gem trading alike.

About GIA

Established in 1931, the Gemological Institute of America is the world's foremost authority on diamonds, colored stones, and pearls. A nonprofit institute, GIA's mission is to ensure the public trust in gems and jewelry by upholding the highest standards of integrity, academics, science, and professionalism through education, research, laboratory services, and instrument development. Visit www.gia.edu